Synthetic Drug Company Limit

SNAP COMMERCIAL ANALYSIS

Babington

OTTAWA
THORBURN & ABBOTT, 113 Sparks Street
1912

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PREFACE

SNAP COMMERCIAL ANALYSIS

March 12th, 1912.

An analyst in general practice has often to give an opinion on an article, in many cases a qualitative examination is sufficient, in others a quantitative analysis of the essential point is necessary. In alcoholimetry, alkalinity and acidimetry, the determinations are made with care, other constituents being neglected, consequently time is the essential, with reasonable accuracy.

In these analysis, all methods of saving time are used, viz., factors, conversion tables, etc., no references are given, and as little text as possible, as the analyst is supposed to have reference books. For the same reason the methods are mostly gravimetric as it is quicker to make a gravimetric estimation for a single determination, than to make and standardize a volumetric solution.

The methods used are not official; they are notes from a rough note-book. The analyst has full discretion.

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Analyst,
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ACETONE

$C3H6O3$, Acetic ketone, Pyro acetic spirit, Methyl acetone, Boiling point 56°C. Resembles an alcohol, except that the flame is colored yellow, it is separated from its solutions by Calcium chloride. There are two acetones on the market. The first prepared by the dry distillation of Calcium or sodium acetates, is practically pure, containing about 80% of acetone, the balance being water, a trace of methyl alcohol and tar oils. The second is obtained by the fractionization of wood spirit and contains from 30 to 50% of acetone, the balance being methyl alcohol and water. This is sold as commercial acetone.

Acetone has a large use in the solution of gums and nitro-cellulose. As some gum resins and nitro-cellulose are soluble with difficulty in both Ethyl and Methyl alcohol, but freely soluble in acetone or wood spirit containing Acetone.

IDENTIFICATION.

The separation of acetone is not simple although its identification is. The calcium chloride separation (vide Allen, page 76) is the best, and although not accurate, is sufficient for all practical purposes.

The Bisulphite separation is not clean enough for practice.

The iodoform test (Allen, page 76) is a good identification and yields good comparative results, but the volatility of the iodoform renders it inaccurate.

ANALYSIS.

*)30 cc's of acetone, + 100 cc's saturated calcium chloride sol. Add powdered cacium chloride to excess, then shake in a separator (graduated). Let stand two hours and read off the upper layer which equals the acetone. The lower layer can be separated then diluted and distilled to 50cc.

The percentage of the methyl alcohol can then be ascertained by the specific gravity of the distillate and identified by platinized asbestos, formaldehyde being formed. The acetone in the original can be determined by the iodoform method. (Allen, page 77).

The following results (see Jour. Soc. Chem. Ind., March, 1907, Wood spirit in acetone).

	Pure Mercks	Commercial
Sp. Gr. (15.5)	.7971	.8338
Boiling point	54-55°C.	54-55°C.
Fract. Dist.	75% at 57-68°C.	25% at 60-70°C.
CaCL2 Sep.	48-50	40-45
Chromic acid test	Slight reduction	Reduction
Pt. black test	Trace formaldehyde	Formaldehyde strong
Iodoform test	31%	26%
Boric acid test	.3 cc's N/2 NaoH.	1 cc N/2 NaOH
See Methyl alcohol		

From the above it seems that the Calcium chloride test is the best as the others are vitiated by alcohol and water present.

IODOFORM TEST

1 cc. + 40 cc's. NaOH + 30 cc's iodine solution washed with three (15 cc portions) of ether. = 1.755 grams of CHI3 which equals 25.8% of Acetone (394 CHI3 = 58 acetone).

Process, 1 cc. dissolved in 40cc's of soda sol., Iodine in KI added to excess, then washed, separated with 25 cc's, 15 cc's, 10 cc's ether respectively. The ether separations joined and allowed to evaporate spontaneously dried over H2SO4.

ANALYSIS. C.P.

Samples labelled	C.P.	C.P.	A	B	C	D	E	F
Specific gravity.........	.7971	.8338	.8503	.7984			.8254	
Boiling point °c..........	55	54.5			34%			
$CaCL_2$ sep	48%	40%	20%	80%		30%	30%	80%
Iod. sep.	31%	25.7%			stro.			
Alc. Formaldehyde test	fair	stro.	stro.	slt.	68.7	stro.		stro.
Alc. Sp. Gr. ($CaCL_2$) dist	35.95	33.6	48.6	14.5				48%
Alc. Meth. Borate......	.3cc's	1.0	cc's n/4 alk.					

D—Wood alcohol, gave a gum resin on evaporation therefore a finish varnish.

F—The calc. chlor. sep. formed a milky emulsion with water, a compound, sol. in gasoline therefore tar oils.

*Refer Methyl alcohol.

Extract from the Journal of the Society of Chemical Industry, of March 30th, 1907, being a paper read before the Canadian section of the Society on February 7th, of the same year, by the author.

WOOD SPIRIT IN ACETONE

During the analyses of varnish removers, which are generally composed of a solution of paraffine wax in benzol, mixed with either acetone, or wood spirit rich in acetone, the question arose as to whether acetone or wood spirit, or wood spirit so rich in acetone that it might be termed acetone, had been used. The so-called pure acetone contains little or no methyl alcohol, but commercial acteone, being often obtained by fractioning wood spirit, may contain fairly large proportions of wood spirit, and still be commercially known as acetone.

Attempted to make the various qualitative tests for methyl alcohol quantitative, but the results in the main were negative. First attempted to fix the acetone and free the alcohol for determination as follows:

(1) By salting out by calcium chloride, and ultimately saturating the sol. with powdered calcium chloride, the bulk of the acetone separated, but enough remained in solution to nullify the test for alcohol.

(2) Evaporation with calcium chloride failed, since the acetone and alcohol both evaporated.

(3) Separation of the acetone by alkalie sulphite failed as in (1).

(4) Separating the alcohol as methyl exalate failed as in (1) and (3).

(5) Reynolds' test with mercuric chloride failed, not being quantitative .

(6) Oxidation by chromic acid solution, which gives qualitative results, is useless quantitatively, since the formic acid produced was further oxidized.

(7) Oxidation to formaldehyde by platinum black, which is an excellent method of distinguishing between acetone, ethyl alcohol, and methyl alcohol, fails quantitatively as in (6).

The qualitative test is as follows:

A pledget of platinized asbestos is prepared by soaking asbestos in a solution of platinic chloride and igniting until sufficient platinum is deposited. If a few drops of the liquid be dropped on the recently ignited platinum, there is no particular odour with acetone or with ethyl alcohol, only the odour of aldehyde, but with methyl alcohol or with acetone rich in wod spirit, the odour of formaldehyde is characteristic. I suggest this test as a qualitative test, together with the chromic acid test; the platinum will show methyl alcohol, the chromic acid wil lshow methyl and methyl alcohols; pure acetone reduces chromic acid slowly.

Rich and Bardy's method was tried, but abandoned on account of the time occupied.

Found the iodoform method for determining the acetone fairly satisfactory when the acetone content was high; but found that the gravimetric method was inaccurate when the acetone was low, as the ether idodform layer undergoes spontaneous decomposition, with liberation of iodine, and washing with soda solution only temporarily removes it, as it forms again on evaporation. Did not continue, as alcohol was the objective point, but consider the volumetric process preferable. (Allen, page 77).

EXAMINATION OF VARNISH REMOVERS

100 cc's is shaken with three successive portions of 50cc's water; the contraction represents roughly the amount of acetone of wood alcohol used, the supernatant layer of benzol and paraffin. The latter is divided into two portions, one of which is evaporated for the identification of paraffine, the other being distilled to identify the solvent.

The united aqueous extracts are distilled to the volume of the contraction observed (which will be roughly the amount of alcohol or acetone used). If a blue flame is obtained by the flame test, probably only alcohol is present. The chromic acid test and the formaldehyde test are also then applied. If alcohol is detected 25cc's is distilled with boracic acid as described under Methyl Alcohol.

A sample of chemically pure methyl alcohol gave the following figures:

Iodofcorm test, trace; boric acid test, 46.5 cc's N/2 alkalie.

From the following table a fair approximation of the amount of methyl alcohol present can be obtained. Do not claim it accurate, but it is rapid and sufficiently accurate for technical purposes:

Acetone %.	Methyl Alcohol %.	CCC'S of N/2 NAOH Sol. Used.
0.0	100.0	46.5
20.0	80.0	38.0
40.0	60.0	24.5
60.0	40.0	13.0
80.0	20.0	6.0

Wood spirit usually requires about 34 cc's of sodium hydroxide solution.

METHYL ALCOHOL CH4O

Wood spirit, cologne spirit, excelsion spirit, etc.

Wood alcohol is now so well purified that it has not the characteristic odour in many cases, its boiling 54 to 55°C. differs slightly to Acetone which is 56°C. Therefore its separation by fractional distillation is impossible, and from ethyl alcohol with a boiling point of 78°C. it is only partial. Its detecton is simple, but its quantitative determination is difficult.

DETECTION.

Formaldehyde test (see acetone), Bardy's test (Allen, page 53), Riche & Bardy's test (Allen, page 75, Vol. 1), Reynolds' test and the methyl borate test (author), as follows:

FROM A PAPER TO THE SOC. CHEM. IND.

Tried to obtain a volatile ester of methyl alcohol which could be titrated and would yield a number analogous to the Reichert number in butter analysis. After some experiments found the boric ester to give fairly good results; at all events, it gave a figure of methyl alcohol, and am of the opinion that if the analysis were conducted with care, the results would be of practical application.

The test is conducted as follows: 25 cc's of the spirit and 2 grams of boric acid are placed in a 100 cc fractional distillation flask (with pieces of pumice or platinum spirals to prevent bumping) provided with a long stemmed funnel, and connected with a condenser and a trapped flask receiver. When all connections are tight 20 cc's of glycerin and 20 cc's of water are placed in the receiver and the spirit distilled to dryness by the aid of gentle heat. When cool 25 cc's of water is added to the contents of the flask by the separating funnel, the condenser is washed with from 10 to 15 cc's of the water distilled and the glycerine solution is titrated with N/2 sodium hydroxide solution, using phenolphthalein as indicator, the methyl alcohol being calculated from the table given below. If the esterification were carried out in a pressure flask and distillation performed more carefully, the results would be much more accurate, but the above method has the advantage, in technical work, inasmuch that four distillations can be done in one hour.

A sample of chemically pure methyl alcohol gave the following figures: Iodoform test, trace; boric acid test, 46:5 cc's N/2 alkali.

See table under Acetone, page

The refractometer is also used to estimate methyl alcohol.

Methylated spirit is composed of 90% rectified spirit and 10% commercial wood spirit.

I know of no means at present of determining quantitatively rapidly, the proportion of methyl alcohol in ethyl. Fractional distillation carefully conducted and separating the distillate into a number of fractions and applying the chemical tests and the refractometer to the different fractions would probably give a good approximation.

ETHYL ALCOHOL C2H6O

This important article of commerce has been well threshed out in text-books, that only the practical application of analysis is here considered (Hehners tables used).

SPIRITS

In distilling ordinary spirit, such as brandy, etc., it is not necessary to have a tapped receiver, if the following conditions are observed: Use a vertical condenser letting the end of condenser project well into the receiver. If a 100 or 200 cc

flask is used, let the end of the condenser go down into the neck of the flask as far as the bulb. Close the neck of the flask with a pledget of cotton wool, loosely packed, and conduct distillation slowly. Measure the sample before distillation at room temperature and let distillate attain room temp. before making up to the mark. It is not necessary to dilute the spirit and distill to twice its volume and double the % found, as you introduce through the contracting of volume more error than you are likely to make through a straight distillation.

SAMPLE—LIQUEUR BRANDY.

100 cc's transferred to distilling flask, wash with three successive portions of 10 cc's H_2O, distilled slowly from 80 to 90 cc's. Let stand, make up to mark, cool, the specific gravity in a picnometer at 15°C. Sp. Gr.=.8998=58.14 alc. by Wt. =65.9 alc. by Vol.=115.55 proof spirits—15.5° over proof.

Comparing it with the result obtained by taking 50 cc's and diluting to 150 cc and distilling it over 110 cc's. In this case the specific gravity was .9632 which equals, alc. by weight 26.40 plus 1/10 equals 29.0 × 2=58.0=114.2% proof spirits, or 14.2 over proof; therefore a straight distillation is more accurate.

ANISEED BRANDY.

100 cc's as above distilled to 100 cc. the distilalte being milky on account of the volatile oil of aniseed present, which is insoluble in a weak solution of alcohol. Made the distillate up to 200 cc's to ensure complete separation, transferred to a separating funnel and shook with 50 cc's heavy gasoline, separated, and cooled the spirit layer, then determined the specific gravity, multiplying the alcohol found by 2.

Specific Gravity.	**Alc. by Wt.**	**Alc. by Vol.**	**Proof Spts.**
.9736	18.38	22.5	79%

STRONG ALCOHOL (RECTIFIED SPIRITS OR ABSOLUTE)

The Sykes hydrometer being fitted for ordinary spirits' strengths, is not sufficiently accurate for strong spirits. The specific gravity determined by the specific gravity bottle, or preferably by the Wesphal or Mohr's balance, is more accurate and also more desirable as the excise duties are high=$2.40 per proof gallon.

WINE AND WEAK ALCOHOLS.

Sykes hydrometer here should not be used, as is only divided into 2/10 divisions. As each division equals .6% proof spirit, it is quite enough to throw it one way or the other in a light wine; in such cases a special wine hydrometer should be used reading in proof spirits, or the specific gravity taken by the specific gravity bottle.

WINE.

200 cc's distilled slowly to about 180 cc's, the distillate made up to mark at room temperature, and the specific gravity taken by pincnometer.

The addition of alkalie to neutralize free acid is seldom necessary, except in very acid clarets, etc. Found to make no difference in practical results.

WINE (RENO).

100 cc's distilled to 100. Specific gravity=.9772, alc. by wt.=15.5%, by vol.=19.08%, proof spirits=33.44%.

BORDEAUX.

Sp. Gr. .9876, alc. by wt. 7.53, alc. by vol. 9.37, proof spirits 16.42.

RHINE.

Sp. Gr. .9877, alc. by wt. 7.47, alc. by vol. 9.29, proof spirits 16.28.

Cider and beer are done in the same way.

The flame test for alcohol is a useful preliminary test, and is conducted as follows: 50 cc's of the sample are heated in a small-mouthed erlenmeyer flask. Just before it boils, if alcohol is present, it will be shown by the condensation of oily drops about the neck of the flask and on application of light to mouth of the flask the vapour burns with the characteristic blue flame. This qualitative test will show as little as 2% of alcohol, or 4% proof spirits, it will show it in beer, for example, and a rough estimation can be made from the height and continuance of the flame as to its being alcoholic or strongly alcoholic. If it is proof strength or over, a glass rod dipped in the sample will take fire when passed through a flame. In cases where it is doubtful that the low specific gravity of the distillate is due to alcohol or not, a flame test on the distillate, or on the concentrated distillate will often decide the point. In cases of very low alcohol, return your distillate to the flask and distill over from 5 to 10 cc's and apply rod and flame test.

Alcohol, in essential oils, perfumes, tinctures, etc., fusel oil, amyl acetate. Take 50 cc's add 100 cc's saturated salt (nacl) solution, shake well in separator, let stand until clear; a precipation of salt is an indication of alcohol. Separate the salt solution, distill 50 cc's and determine the sp. gr. and identify alcohol by the usual tests. The amount of contraction of upper layer is a rough guide to the amount of 80% alcohol used.

PROOF SPIRIT.

The Customs and Excise express and tax alcohol in terms of proof spirits.

Proof spirit of Great Britain is "a dilute spirit, of which 13 volumes shall weigh the same as 12 volumes of water at same temperature. Sp. Gr. = .9[illegible]984 at 60° F. or a Sp. Gr. of .91817 at 62° Fahr. It contains (see Fownes and Hehner) alcohol by weight, 49.24; by volume, 57.06; proof spirits, 100;

absolute alcohol, 75¼ O.P., or 175.25 proof spirits. Thus 100 volumes of absolute alcohol would = 175.25 volumes of proof spirit, and the duty at $2.40 per gallon (proof) would be on that basis, that is, 175.25×$2.40. Taking 20 U.P., that is, 80% proof spirits, the duty is on 80 proof gallons to the 100 entered; taking 20 O.P., which equals 120% proof, the duty is on 120 proof gallons to the 100 entered.

Now this convenient arrangement for duty purposes is not so irrational as it appears. It is grounded on weight, whereas the other methods of computing alcohol are grounded on alcohol by volume the specific gravity of absolute alcohol is open to doubt; it leads to misunderstanding when proof spirit is compared with alcohol of other nations. Continental nations use the Gay Lussac Centismal Alcoholometer, reading absolute alcohol by volume, the specific gravity being .7947. Since then the specific gravity of alcohol×.7938 (Keene's handbook), so that the standard is uncertain. The fact is so well known that tables are given in Salleron and Dejordins "Instruments de Precision Applique a l'Oenologue," for converting degrees Gay Lussac into Sykes hydrometer and Tralles hydrometer tables. (In the United States Tralles tables are legalized). The alcohol is % by volume. The proof spirit used by the United States excise is described as an alcohol liquor containing ½ its volume of alcohol (sp. gr. .7939) giving a proof spirit of sp. gr. .93353, water at 4° C. in United States=1.

Therefore British at 60° F.=Sp. gr. 91984.
" Us. St. " " 9341.

The United States proof is 42.7 alcohol by weight; British is 49.24. So the spirit strengths of the different nations are not comparative, neither is the volume. Continental nations measure in litres, British, Imperial gallon equals 160 oz., wine gallon=128 oz., the United States standard being wine measure.

ACETIC ACID C2H3O2

Analysis: Specific gravity by the pincnometer and referring to tables for approximate strength.

Total solids: 25 cc's evaporated in platinum dish on the water bath to constant weight.

Ash: Ignite the total solids at low red heat; ash should be alkaline, if neutral, probably mineral acids present.

Acidity: 10 cc's acid plus 50 cc's of water titrated by N. NaOH using phenolphthaline as indicator, color should not return within one minute after titration has been completed. The number of cc's soda used × .06 × 10=% of acetic acid present, if by weight the number of cc's soda × .06 × 100 divided by 10 × sp. gr. gives the % of acetic acid by weight. The percentage of acetic acid × .85 gives the % of acetic anhydride. If the enquiry is as to whether it is crude or refined, the permanganate test is an indication, but the presence of tar oils, which can be removed with gasoline, its empyreumatic odor, color, high total solids, fusible sulphate ash in the case of distilled acid from sodium acetate, and lime from calcium acetate are more distinctive.

Permanganate Test (Sol. 1 gram of KMnO4 per litre).

Dilute acid to proof strength, i.e., 6% acetic anhydride (100 cc's using 118 cc's of N. NaOH).

Take 50 cc's, add 50 cc's water, and distill over 50 cc's. Take 10 cc's of this, and add the KMnO4 drop by drop, until pink color persists for one minute. 10 cc's should not take more than .2 cc's of the KMnO4 sol.

VINEGAR

As above for acetic acid. Some malt vinegars and so-called vinegar essences are so dark that the color of the phenolphthaline indicator is more or less masked. This can be sometimes evaded by large dilution and reading to the change of

Customs house reckon as 'Acetic Anhydride' (6%: Regs) no tests are given color not waiting for the purple coloration. If obstinate distill to dryness in a current of steam and titrate the distillate with N. NaOH, or by adding MgCO? or MgO, and estimating the undisolved MgO.

ACETATES OF SODA; GREY OR BROWN.

2 to 5 grams dissolved in a minimum quantity of water, an excess of syrupy phosphoric acid added and distilled twice to small bulk in a current of steam and titrating the distillate with N. NaOH.

ANALYSIS.

Acetic acid; 10 cc's, used 52.9 cc's N. NaOH × .06×10=31.74% of acetic aid × .85 equalled 27.0% of acetic anhydride. Total solids, .07, ash alkaline.

Vinegar (white), 10 cc's × 7.6 × 10=4.56 by .85, equalled 3.9% ac, an.

Vinegar (malt), 10 cc's=9.2 ×10=5.50 by .85, equalled 4.7% ac an.

Vinegar (essence), very dark, so distilled 50 cc's 3 times to dryness, diluted distillate to 250 cc's .25 cc's (.5 cc's essence) took 55.6 × .06 ×.85 ×20, equalled 56.7% of acetic anhydride.

Acetic acid is sometimes designated by a number; this is based on 4% commercial proof, thus No. 8 acid is that acetic acid which when dilut[illegible]d parts, will yield 4% acid, that is proof commercial. Therefore, No. 8 is equal to 32% acetic acid, No. 12 to 48%, and so on. In the trade, vinegar numbers are used that equal the number of grains of dried sodium carbonate neut. by one fluid ounce (Imp.). Thus ½ Na2CO3: C2H4O2; ::53:60::1=1.132. Therefore the No. × 1.132 equals the grains absolute acid per fluid ounce of 437 grains × sp. gr. =the number.

In the United States the vinegar or acetic acid is reckoned in terms necessary to neutralize 35 grains KHCO3 per ounce Troy. (Item 28, U.S. tariff).

ALUMS

Besides alum, alum cake, aluminium sulphate, burnt alum, and especialy soda alum are used.

The largest amount at present used, is soda alum, which has many advantages over burnt alum and aluminium sulphate as a cream of tartar substitute. For example, it parts with its water of crystillation at steam heat, consequently there is little or no insoluble Al_2O_3 when boiled with water, the slight precipate forming, redissolving. It also contains little water, saving freight.

ANALYSIS: sulphate of alumina.

D was found to be sulphate of alumina containing no Na, K, or NH_3.

Alum cake differs from sulphate of alumina by being crude, containing undecomposed china clay and silicates; some samples are nearly pure, others contain from 10 to 15% of Al_2O_3.

ALKALI

The analysis of alkali is so well known by Lunge and Hurters work that the processes are official, but new alkalies are appearing to meet trade requirements; for instance, sal soda contains 62.18% of water, and 21.8% alkali as Na_2O; soda ash contains 58.5% of alkali as Na_2O, but for cleaning purposes, scourerers, etc., soda ash is too lumpy, from absorption of water and too drastic. No one wants to pay freight on 60% of water; consequently mixtures of the normal carbonate and bicarbonate are generally used. Whether these mixtures are due to incomplete bicarbonation or actual admixture of bicarbonate has nothing to do with the question. These compounds have nearly replaced sal soda where freight is economy. These are termed Sesqui carbonate, Brunner Mond & Co. "Concentrated crystal soda," etc., of which one pound is equal to two pounds of washing soda.

ANALYSIS.

Soda ash, 5 grams dissolved in 250 cc's H_2O.

Total alkali, 50 cc's + 25 cc's normal sulphuric acid, boiling until effervescence of carbon dioxide ceases, then titarating back by normal sodium hydrate. 50 cc's taken = 7.4 of the soda. 25=7.4=17.6 cc's used up.

Calculated to Sodium Carbonate, 17.6 by .053 by 100, equalled 93.28 Na_2CO_3.

Calculated to Sodium Oxide, 17.6 by .031 by 100, equalled 54.5 Na_2O.

CAUSTIC ALKALI

50 cc's ppted by barium chloride (hot) cooled, diluted to 100 cc mark and let stand. 50 cc's supernatant liquid plus phenolphthalein gave no coloration, therefore no caustic alkali.

BICARBONATE

50 cc's + 25 cc's normal NaOH, +$BaCl_2$, heated. Let cool, dil. to 100 cc and titrated by normal HCl. The principle of this process depends upon the fact that with excess of NaOH the bicarbonate returns to the normal carbonate and is ppted by $BaCl_2$ as $BaCO_3$, every equivalent of NaOH used up being an equivalent of $NaHCO_3$. $BaCO_3$ formed not interfering with the titration. 50 cc's + 25 cc's N. NaOH + $BaCl_2$ used up 24.7 cc's N. HCl. 25.0 − 24.7 = .3 cc's used to convert the bicarbonate to the normal carbonate.

.3 × .084 × 100 = 2.52% $NaHCO_3$.

Therefore sample practically soda ash as it contained only 2.5% $NaHCO_3$, and is free from NaOH.

CONCENTRATED SAL SODA

(Sodium sesqui carbonate), 5 grams in 250 cc's.

Total alkali, 50 cc's + 25 cc's N. H2SO4 and boiled, = 10.9 cc's N. NaOH. 25.0 – 10.9–14.1 cc's normal alkali = 14.1 × .053 × 100 = 74.73 as NA2CO3; 14.1 × .031 × 100 = 43.71 as Na2O.

Caustic, 50 cc's ppted hot by BaC12, diluted to 100 cc's, gave a neutral filtrate, therefore no caustic alkali.

Bicarbonate, 50 c's + 25 cc N. NaOH + BaC12 to 100 cc's = 20.5 cc's N. HCL .25 – 20.5 gixes 4.5 cc's used up.

4.5 × .084 × 100 = 37.8 of NaHCO3. Calculated the 37.8 NaHCO3 to Na2O: 168: 37.8::62 = 14.0, gives 29.7. Calculating this to Na2CO3, factor = 1.7 = 50.4% Na2CO3.

Sodium carbonate	50.4%
Sodium bicarbonate	37.8%
Water (by difference)	11.8%
	100.0%

Caustic Soda is done the same way, but weighed in a closed weighing tube.

Sodium peroxide known as its evolving O2 with water.

In the following table A is a "cleaner," B "alkali," C "Sod. Carb.," D "simplexine," E wyandotte," F "lye," G "cleaner," soda salts, I "caustic soda," ash, J "cleaner."

Brunner, Mond & Co.'s analysis of refined and recrystallized bicarbonate of soda. Bicarbonate of soda, 97.257%; mono-carbonate of soda, 1.900%; sudphate of soda, trace; chloride of sodium, 0.023%; Moisture, 0.820%; insoluble, nil.

PURE SODA CRYSTALS

ANALYSIS.

Total alkali (Na_2O) 21.5% which is equivalent to: Crystallised carbonate of soda ($Na_2Co_3\ 10\ H_2O$) 99.18%; chloride of soda (common salt), 0.18%; sulphate of soda, 0.12%; moisture, 0.52%.

CONCENTRATED CRYSTAL SODA

(SESQUI-CARBONATE OF SODA).

Carbonate of soda, 46.57%; bicarbonate of soda, 37.00%; water of crystallization, 16.24%; chloride of soda (common salt), 0.18%.

It will be seen that it contains much less water of crystallization than soda crystals, and only half the quantity is required to do the same work.

"ENGLISH" TEST OF ALKALIES INTO ACTUAL CARBONATE OF SODA AND CAUSTIC SODA.

In England the test of Alkalies, such as Soda Ash (Carbonate of Soda) and Caustic Soda, is expressed commercially, not as the auctual percentage of Carbonate or Caustic Soda which they contain, but in "English degrees" (also known as "Newcastle degrees," or "Alkali test"), which represent the percentage of Sodium Oxide (Na_2O) contained in them, with a variation from the real percentage of Sodium Oxide due to the fact that the "English degrees" are founded on the supposition that the atomic weight of Sodium is 24, which was the recognized atomic weight at the time the test was instituted, whereas later investigation has proved that it is actually 23.

ANALYSIS.

	A	B	C	D	E	F	G	H	I & J
Water (diff.)	11.4	15.33	12.04	..	23.9	..	6.7	..	..
Total Alkali, Na_2CO_3	74.73	72.08	75.36	85.74	30.74	98.5	48.8	45.1	75.2
Total Alkali, Na_2O...	43.71	..	..	48.98	..	..	..	..	34.9
Caustic Alkali, $NaOH$	..	..	..	68.0	..	71.2	..	..	.5
Bicarb, $NaHCO_3$	37.80	12.39	12.60	..	45.36	..	44.5	72.3	..

ANTIMONINE

Lactate of antimony used as a mordant in dyeing. A white brownish paste, gave reaction of Sb. and an organic acid.

Question, identification of antimony and lactic acid.

ANALYSIS.

Suspended a weighted portion (2 to 5 grams) in warm H_2O and pass H_2S to saturation, separate the Sb. as $Sb_2S_3 + S$; filter on Gooch's crucible, wash well and dry at 100. Extract in Soxhlet by CS_2 to remove the ppted. sulphur, dry and weigh. Confirm Sb. by the usual tests, the quickest being to fuse with KCN in porcelain crucible and obtain a button of antimony. The filtrate from the H_2S is boiled, filtered, if necessary, and the lactic acid determined as zinc lactate. Add $ZnCO_3$, warm, filter and evaporate filtrate. Dry at 100 and estimate this as zinc lactate. Confirm by determining the zinc as ZnO and calculating the organic acid as usual.

EXAMPLE.

The zinc lactate was recrystallized three times from absolute alcohol to obtain pure, dried at 100, and a portion ignited to ZnO.

Taken .914 zinc lactate = .252 ZnO (as zinc lactate, $Zn(C_3H_5O_3)_2 + 20 H_2O = 255$, the zinc – 65, therefore $\frac{255}{65} = 3.9$ coefficient).

.252 ZnO = .2023 Zn. × 3.9 − .7878 + 20 H_2O − 7878 + 157 lactic = .944 = 914 calculated back to .944 which = acid crude.

ANTIMONIAL LEAD

Is a product of the refining of antimonial silver ores and is used in the preparation of type and stereotype metals.

ANALYSIS.

One gram of the filings dissolved in dilute nitric acid, evaporated to dryness on a water bath, drenched HNO_3 evaporated to dryness, took up with water + HNO_3 let stand, filtered, weighed the Sb_2O_3 = 12.36% Sb. Fused with NaOH diluted, let stand and filtered out the sodium Met. antimoniate, this was fused with KCN, obtaining a button of Sb. confirmed. The filtrate from the metantimoniate was acidified by HCl and tested for tin, which was found absent.

The nitric acid filtrate was evaporated in a beaker to small bulk, diluted sulphuric acid added, re-evaporated, diulted to 100 cc's and about 20 cc's alcohol added, let stand and Pb. determined as $PbSO_4$; 1.271 $PbSO_4$ = 86.8 Pb. The filtrate from the $PbSO_4$ was evaporated and the Cu and Zn tested for. Only a trace of each found.

Analysis.	1	2	3
Lead	86.18	79.00	85.64
Antimony	12.40	17.00	14.00
Copper	——	2.00	——
Zinc	——	——	——
Tin	——	2.00	——
	99.58	100.00	99.64

BATES

Bates are used in tanning leather to remove the lime used in dehairing the hide. Mineral acids ,acetic acid, and to some extent, butryic acid are inadmissable, as they dissolve the gelatine and decrease the weight, and also attack the structure of the hide. Consequently the Lactic ferment is generally used, as lactic acid and lactates have the power of dissolving relatively large quantities of lime. This is also assisted by the CO_2 and other solvents developed by fermentation. Glucose has also been used to form a soluble saccharrate of lime. Poultry dung is also used on account of the soluble action of Uric and Hippuric acids; they are generally pastes.

ANALYSIS.

Identification of substances used, principally microscopic.

Bate, found to be bran and decomposing cheese.

Puerine, found to be bran and decomposing cheese.

Puerine, found to be bran and decomposing cheese, with apparently dung.

Bate, bran with a ferment. Microscope—micro organisms.

Bate, bran and swarming with micro-organisms.

Bate, a brown liquid, case in odour, no ash, Micro. swarming rod bacilli.

Bate bisulphite of soda.

Bate, a brown liquid, casein odour, no ash, micro. spores, a few rod bacilli, but swarming with globular micro organisms.

General opinion: Lactic ferment or culture.

BRASS

In filings, 2.5 grams dissolved in dilute nitric acid, evaporated on a water bath, drenched with HNO3 and evaporated to dryness. Took up with 50 cc's water + 2 cc's of nitric acid. Let stand and filtered, no residue therefore no Sb or Sn. Made up to 200 cc's, took 50 cc's (.5 grame) evaporated in a breaker with 1 0cc's (1 in 10) H2SO4 until HNO3 driven off, no PbSO4, therefore no lead. Transferred to platinum crucible of 50 cc's capacity and electrolyzed (3 volts). complete precipitation of the copper in two hours. Cu = .251 × 2 = 50.2% of copper. The copper free residue transferred to a 10 0cc silver crucible; NH4OH added until neutral, then 4 grams of ammonium oxalate, connected for electrolysis (4 volts), failed only 2% of zinc being deposited. Took copper free residue, ppted by sodium carbonate and ignited to ZnO.

Cu. – .251 × 2 – 50.2 Cu: ZnO – .290 – 23.3 Xn × 2 –46.6 + 2 Zn (electro) – 6|

Analysis:

Copper	50.2
Zinc	48.6
	98.8

Time, 4 hours.

BORAX AND BORACIC ACID

A. In "preservatives" Honig and Spitz method, Jour. Chem. Ind., October, 1896, page 743. One gram dissolved in 50 cc's of water, using methyl orange as indicator. Titrated by $\frac{N}{2}$ HC1 calculated to N2O = alkali.

B. To neutral solution added 50 cc's of glycerine + phenolphthalein titrated by $\frac{N}{2}$ NaOH = B2O3.

EXAMPLE—BORAX.

A. 10.7 $\frac{N}{2}$ HCl × .0155 – 16.58% Na_2O (theory 16.3%).

B. 21.9 N NaOH × .0175 – 36.32% B_2O_3 (theory 36.6%)

PRESERVATIVES

Cream preservative contains 9% sodium benzoate, by HCl + $CHCl_3$ extr.

A. 5.7 $\frac{N}{2}$ HCl × .0155 – 9.14% Na_2O.

B. 32.5 NaOH × .0175 – 56.8 B_2O_3 (as borax – 36.3, therefore 56.8 – 36.3 = 20.5 free boracic acid).

Milk preservative; no organic preservative found.

A. 5.6 $\frac{N}{2}$ HCl × .0155 = 8.68% Na_2O.

B. 33.3 $\frac{N}{2}$ NaOH × .0175 = 58.27 B_2O_3:: 58.3 = 36.3 = 22.0 boracic acid.

Meat preservative; no organic preservative found.

A. 5.5 $\frac{N}{2}$ HCl × .0155 = 8.52% Na_2O.

B. 33.9 $\frac{N}{2}$ NaOH × .0175 – 59.32% B_2O_3 (59.3 – 36.3 = 23.0% free boracic acid).

COAL

Ordinary approximate analysis of coal.

First. Simply identification, i.e., is sample bituminous, semi-bituminous, sem-anthracite or anthracite.

Second. Question of economic value ,total carbon, ash and physical characteristics.

Third. Calorific value, determined by calorimeter; last not usual in rapid analysis.

SNAP COMMERCIAL ANALYSIS.

ANALYSIS.

Results depend largely on careful sampling, a small piece about the size of a hazel nut being broken off of each lump and about 100 grams roughly ground. This is sieved through three sieves, the first (coarse) rejected; second, medium, kept for moisture; the third used for volatile and fixed carbon and ash.

Moisture. 5 to 10 grams dried for 4 hours at 110°C. Loss equals the moisture.

Fixed carbon and ash. One gram in a flat platinum dish and roasted at red heat in a muffle until completely ashed, usually takes from 20 to 30 minutes. Loss equals the carbon, vol. matter and moisture – residue = ash.

An electric muffle furnace used as the platinum is not attacked, as it is by gas. The character of the coke is observed also the ash.

EXAMPLE—PEA COAL.

Moisture, 5 grams at 110°C.; loss $\frac{.029 \times 100}{5} = 0.60\%$.

Volatile matter, 2 grams 4 minutes in closed crucible at red heat, in electric furnace, loss $-\frac{.169 \times 100}{2} - 8.45$. The moisture $\frac{.115 \times 100}{1} - 11.5$ ash = 80.05 fixed carbon = moisture + vol subtracted from this leaves 7.85, coke, non-caking, friable.

Ash and fixed carbon, one gram in muffle 30 minutes – matter + ash –100.

RESULT.

Moisture	0.60%	
Vol. matter	7.85	Non-caking
Fixed carbon	80.05	
Ash	11.15	(white)
	99.05	

Interpretation, results should be calculated on dry coal. Any recognized official standard taken. Mills & Rowen Chem. Tech.

COAL (MILLS & ROWAN).

CLASS.	Vol. Matter	Fixed Carb.	Ash	Coke
Anthracite	5.0	90.0	5.0	Non coking.
Semi Anthracite......	12.0	86.0	2.0	Slt. "
" Bituminous.....	16 to 20	70.0	10.0	Coking.
Bituminous...........	30.5	60.0	1 to 3	Str. Coking.

Coal classification, Mining Eng.

By determining ratio between fixed and volatile carbon, neglecting all other determinations.

			Ratio	V. C.
			C	
Anthracite	1	99.1	89	11
Semi Anthracite..............	17	93.7	84	16
" Bituminous............	16	84.9	81	19
Bituminous..................	20	80.0	47.0	53

Table A is god for normal coals; but when the ash is excesive (over 12%)as in shaly coals, Table B should be used.

COALS.

	Moist	Vol. Carb.	Fixed Carb.	Ash	Coke
Welsh Anthracite........	7.00	11.7	80.1	1.2	Str. Coking.
Coal Dust..................	1.57	27.73	47.80	22.9	" "
Scotch Anthracite.......	2.55	7.65	83.50	6.30	Non "
Anthracite (poor).........	.58	12.32	69.10	18.00	Slt. "
" Briquette.....	1.83	6.87	86.55	4.75	Non "
Semi Bituminous	.87	24.48	30.75	23.96	Str. "
Dust (Bituminous)........	.48	21.52	72.60	5.40	" "
Briquette (?)	.98	8.00	87.31	3.70	Non. "

CREAM THICKENER

Essentialy sucrate of lime solution, with gum tragacanth—a turbid viscous liquid, ignition caramel, white incandescense, alkaline ash—Ca found Polariscope; ½ normal weight ppted by Na_2CO_3 diluting to 100 cc's. Reading. + 11.5 × 2 = 23% cane sugar.

Checked by inverting 50 c's with 2 cc's HC1 making up to 55 cc's. Reading − 3.2 + 1/10 for dilution = 3.5, calculated out by the Clerget method gave 23.4% of cane sugar. Ash, 7.458 grams taken = .451, carbonated ash = 6.05 $CaCO_3$.

COPPER OXIDE

Query, if CuO or whether it contained copper (free), used for refining petroleum.

Moisture, at 110°C—3.67.

Reduced to metal in a current of hydrogen and weighed Cu, also H_2O absorbed by sulphuric acid. 3.5 grame = 2.776 Cu, calculated to CuO 63 : 2.776 : : 79 = 3.481 CuO found, 3.5 taken CuO calculated to % gives 99.5 CuO.

Calculated the CuO from the H_2O.

Thus 18 : 772 : : 79 = 3.39 (evidently a loss) = 2.702% Cu.

Calculated to % $= \frac{2{\cdot}702}{3\ 5}\,\underline{100}$ gives 77.2 (refinery found 75.5% copper). Calculating to the dry, copper found: 76.6 Ref. found 75.5, difference 1%, therefore oxide of copper CuO.

DEGRAS

The different degras and their analysis are well described in Lewkowitsch, on oils, and Allen's Organic analysis, the most distinctive property is the presence of water, it forming an emulsion with an equal amount of warm water. Also the presence of hide is characteristic.

There are a number of imitations which are used for the same purpose, i.e., emulsifying oil which is fish oil with about 2% of soap, detected by its alkaline ash (soda) and absence of hide fragments.

Thickened or blown oil is fish oil "blown," containing no hide fragments.

"Curriers' grease," is stearine sofetned with petroleum oil.

Leather and harness dressing," is degras + petroleum oil.

The analytical results on degras are admittedly uncertain as is natural from its mnufacture; a great deal must be left to the analyst's opinion.

DUTCH METAL

Clippings used for making bronze powder.

Dissolved in HNO3, evaporated down and obtained no Sn. + H2SO4, gave no Pb. H2S = Cu. Third group gave Zn.

One gram dissolved in 5 cc's HNO3 with 1 0cc's water, evaporated and expelled nitric acid with sulphuric diluted to 100 cc's; 50 cc's made alkaline by alkaline tartrate (Fehling) and precipitated boiling by inverted cane sugar, gave .509 Cu2O, calc .to Cu, 143:509::127, giving 45.5%, Cu × 2 = 91.0% of copper. Checked by electrolysis on 50 cc's gave 45.3% = 90.6% of copper.

The filtrate from the tartrate precipitated by hydrogen sulphide as ZnS disolved in HCl and ppted by Na2CO3, filtered and ignited to ZnO giving .026 ZnO or .021 Zn × 2 = 4.2.

As a slight insoluble noticed, the analysis:

Copper	92.0
Zinc	5.0
Imp. (diff.)	3.00
	100.00

DUST ABSORBENT

Used for cleaning carpets, and supposed to be sawdust and oil.

Appearance, an emerald green oily dust.

5 grams extracted in Soxhlet by ether gave .377 × 20 gave 7.54% of oil.

Oil found to be unsaponifiable, a mineral oil.

The oil free residue extracted by water, the water extract evaporated and dried at 100°C.

1.061 × 20 = 21.23% (found by analysis to be NaC1, tit. by $\frac{N}{10}$ AgNO3).

The oil free and salt free residue was ashed, giving 1.2% of ash.

Microscope and also by hand lens gave cellular tissue, probably sawdust as too short for pulp. The green color was extracted by alcohol, and evaporated, giving an napthol odour on igniting the residue obtained: aniline green.

RESULT.

Sawdust	70.03
Mineral oil	7.54
Ash	1.20
Salt (NAC1)	21.23
	100.00

ETHER (ACETIC)

Specific gravity, .8817, practically no free acid, 5 cc's only taking .5 cc's N/10 NaOH.

Ethyl acetate; neutralized 5 cc's with .5 cc's N/10 NaOH, added 75 cc's N/2 KOH, heated in a pressure flask for one hour at 100°C. titrating by N/2 HCl. Used 17.5 cc's subtracted from 91.0 (blank) givesc 73.5 N/2 = 36.7 N. Therefore

36.7 × .088 × 20 gives 64.6% ethyl acetate (Allen, page 187); 20 cc's + 30 cc's saturated calcium chloride solution leaves 18 cc's, a contraction of two cc's, whih is 10%. The calcium chloride solution sol. separated diluted and 50 cc's distilled over. Sp. Gr. of distillate was .9973 equal to 1.88 alcohol by volume × 2.5 (to equal 20 cc's taken), equal to 4.7% of alsohol. Flame and reduction of chromic acid gave alcohol.

RESULTS.

Ethyl acetate	65.0%
Ethyl alcohol	5.0%
Water (diff.)	30.0%
	100.00

ESSENCES

The ge[illegible] essences are flavoring essences, used for culinary purposes and effervescent drinks. They should be the essential flavoring of a fruit or plant in syrup or the essential oil cut with alcohol; but often they are artificial flavoring ethers, compounded and colored with aniline dye. A test is given in "Allen," page 214.

ANALYSIS FOR ALCOHOL.

50 cc's shaken with 50 cc's saturated salt solution, the sodium chloride solution distilled and the sp. gr. taken on 50 cc's of the distillate. Alcohol determined by tables and confirmed by reduction, flame tests, etc. If the essence contains an essential oil—for instance, oil of lemon, the portions of the distillate are turbid, clearing up after sufficient alcohol has come over to effect solution, becoming again turbid or separating on dilution of 50 cc's. To remove this oil or oleo resin ,shake well with 25 cc's of light petroleum ether, and separate. The lower layer take the sp. go. for alcohol and allow the ether to evaporate spontaneously, identifying the oil by odour, etc.

As a natural fruit essence will contain the natural acidity of the fruit, evaporate a portion on the water bath to a syrup expelling the alcohol and volatile oil. Dilute, add neutral CaC12 and separate the tartrate or citrate as calcium salts. Identify the organic acid by the usual tests. The identification of artificial coloring matter is difficult but geeranlly the analine dye can be removed by shaking with redistilled amyl Alcohol evaporating off the amyl. alcohol and identifying the analine dye by the characteristic tests.

I know of no general taste for the analine dyes, but as a rule an ignition will reveal the characteristic napthol odour. Also they are generally sulphonate dyes and the ash gives the SO3 and SO4 reactions, with soda as a base. They are also, as a rule substantive dyes and dye fast on cotton without a mordant. Many tables are given for identification of aniline dyes, but I have found them of doubtful value.

Essence	Alcohol	Nacl Sol.	Remark
Lemon	Strong	Sl. layer	Oil of lemon cut with alcohol.
Cherry Kola......	5% proof	" "	....
Vanilla............	2% "	" "	Ext. vanilla sl'tly alcoholic.
Lemon	Strong	" "	Oil of lemon cut with alcohol.
Lavender	....	Heavy "	" lav. non-alcoholic.
Raspberry	Strong	" "	Odor, amy. acet. & amy. butyr. analine dye.
Pistachio..........	"	" "	" " " & nitro benzole, plus CHC13.
Crabapple (cider).	5.6% P. S.	....	" ethyl aldehyde.
Orange (cider)	51.00% "	....	Oil of lem. plus cit. acid & alchl.
Cream soda........	48.00% "	....	Same as orange cider.
Raspberry color..	....	Sl. layer	Amyl. acet., butyr. & amyl dye.
Strawberry color.	....	" "	Same as raspberry color.

ENAMEL WHITE

Is sodium metantimoniate, used to produce white opaque enamels?

A heavy white powder, ignition, unchanged, white incandescence, Na flame. Insoluble in water, neutral reaction. Dissolved in HCl and tartaric acid. Passed in H_2S, gave Sb_2S_3. Filtered out and identified by fusion with KCN and usual tests and confirmed Sb. The filtrate evaporated in a quartz dish, ignited off the H_2s. The residue was alkaline carbonate, soda flame.

ENAMEL ESSENTIAL

A gray liquid, odour, linseed oil and turpentine. Filtered and washed out the oil and turpentine with ether, the residue being completely soluble in HNO_3., Ash on the original, 16.09 taken, which gave .701 of ash, therefore 4.35%. Dissolved in HNO_3 and evaporated to dryness, no tin. Pb. ppted as $PbSO_4$. Zinc in filtrate ppted as ZnS by H_2S and ignited to ZnO. Filtrate from the Zn ppted by ammonium oxalate—Ca. Ignited to CaO.

Ash	4.35%
Pb.	.12
ZnO	3.22
CaO	.40
	3.74

Therefore probably white lead, zinc white, chalk and oil of turpentine.

EMBALMING FLUIDS

These used to be arsenical solutions, but lately solutions of carbolic acid ,thymol, formaldehyde with alcohol, etc.

SAMPLES.

(1) Liquor arsenicalis.
(2) Thymol + 5.08% alcohol.
(3) Liquor arsenicalis.
(4) Formalin solution.
(5) Formalin solution.
(6) 10% formaldehyde with glycerine.

FISH (PRESERVATIVE)

Used for preserving and hardening bait.

A white crystaline powder, strong odour of formaldehyde (para formaldehyde). The vapor reduced ammonia silver nitrate solution. Ignition fused, alkaline ash. Gave boracic acid reaction with H_2SO + alcohol.

Acids in water solution gave no Cl nor SO_3. Bases gave Na and a trace of Mg. A mixture of Para formaldehyde, borax, free boracic acid and a trace of Mg (impurity).

FILLERS (VARIOUS)

Paint filler (black), a thick black paste, odour linseed oil and turpentine. Ash (63%) insoluble in HCl, 28% which was clay. The 35% was found to be soluble, was $PbCO_3$. Lamp black, no other bases. Therefore white lead, clay and lamp black mixed to a paste with turpentine.

Paper filler, a white powder, sinks in water, unctuos to touch, ignition gave a whitei ncandescent ash. Fused with $KHSO_4$ and examined for bases. Filtered. Residue was SiO_2, confirmed by HFl. Filtered. A little aluminum, no Ca, Mg strong. As the powder sinks in water it is not true ground steatite, but a talcose clay.

Stove filler, iron filings – cement 5% + sal ammoniac

Wood filler, fine ground silica or quartz.

Crack filler, for wood floors, flour, chalk, or whiting made into a paste with varnish, others, casein with lime and flour with wall plaster.

Paper fillers (generally). Satin white = precipitated gypsum Gouveneur pulp, which is disintegrated asbestos, talc and china clays, etc. Barytes for weighted papers.

FIRE EXTINGUISHERS

Liquid, a $CO2$ apparatus ,either syphon or liquid $CO2$ forcing out a solution of calcium chloride or magnesium chloride? The magnesium chloride did not freeze at – 30° Cal.

Solid, sodium bicarbonate, colored by lamp black, oxide of iron, or yellow ochre

$NaHCO3$	95.7
Yellow ochre	4.3
	100.00

FIRE PROOFING

Solid, nearly always magnesia cement, i.e., $MgO + MgC12$, with a wood fibre or asbestos filler or binder, used in tile form in mouldings and moulded to form lagging for steam pipes, etc.

GERMAN SILVER

Sample was a corner for a show case. Its peculiarity was, that it was german silver, but that it had been nickelplated.

"A", sampled the outside by scraping with a three-cornered graver.

"B", sampled the inside by filing.

Analysis, A and B, dissolved in aqua regia and evaporated to a syrup. Ppted the Cu with $H2S$. Redissolved the CuS and PbS in $HNO3$. Added $H2SO4$ and expelled the $HNO3$, gave no lead. The copper was ppted by KOH and ignited to CuO calc to Cu. The filtrate from the $H2S$ boiled, oxidized by potassium chlorate and the Ni and nZ determined by Wohler's methods (Crookes, page 273), as double cyanides, i.e., KOH added in slight excess, then HCN gas passed until resolution (the gas is essential, if you try KCN, you will need a large excess of $H2S$ subsequently, which will load up the solution with KHS). The Zn is ppted in warm solution by $H2S$ and washed, if small dried and ignited to ZnO calc to Zn. The filtrate from the H2S is decomposed by Aqua regia, evap. to small bulk, filtered from S, and Ni ppted by KOH. The NiO is ignited, as it is difficult to wash free from K, digested with water, the K2CO3 washed out, dried and ignited by blast to NiO Calc to Ni.

RESULTS.

"A" .066 grams.

CuO .029 equals $\frac{.023\ \text{Cu} \times 100}{.066}$	Cu	22.5%
NiO .061 equals $\frac{.0479\ \text{Ni} \times 100}{.066}$	Ni	72.6%
Zn (by difference)	Zn	4.9%
		100.00

"B" .133 grams.

110 CuO $\frac{.090\ \text{Cu} \times 100}{.133}$ equals	Cu	67.8%
quals $\frac{.0361 \times 100}{.133}$	Ni	26.5%
lifference)	Zn	5.7%
		100.00

GASOLINE

The ordinary commercial specifications for gasoline, i.e., the specific gravity and boiling point are guides, but in no sense are they definite, as a judicious combination of light and heavy petroleum may give the right sp. gr. and boiling point, and still fail for motor purposes. As gasoline is not a chemical compound, the only recourse in such cases is to fractional distil the product. 200 cc's taken and fractionally distilled to 100°C. cutting off at every 10°, gave the following results:

FRACTIONAL DISTILLATION.

	S.G.	B.P. C°	B.P. C	B.P. F°	30-40	40-50	50-60	60-70	70-80	80-90
Pet. Ether .	.6[illegible]7	22	22-32	86	57%	36%	7%			
Petr. Gas...	.6861	46	52-57	129	9.5%	16.5%	31.5%	18.5%	10%	10%
Cln. Gas....	.7222	66	82-83	179		.75%	2.0%	15.5%	10%	8%
Burn. Gas..	.6957	55	65 67	150		4.0%	14.5%	21.0%	22%	7%
" " ..	.7141	56	72-75	163			2.0%	10.5%	14%	17%

Between 90 and 100 the following are the percentages, respectively: 10, 32, 19, 26%.

Abbreviations, C°, centigrade degrees, C, constant. F°, fahrenheit degrees.

The residue over 100°C., which is equal to 12.5% in the cleaning gasoline.

The following figures may be useful, from Catechism of Steam Engine. Desity in degrees Baume:

Kerosene	43 to 48°
Benzine	57 to 63
Naptha (painters)	57 to 63
Naptha (boat)	76
Gas (engine)	72
Gas (spec. engine)	76
Gas (illuminating)	87

Two samples of fuel gasoline, query, if equal value?

	A.	B.
Specific gravity	.7061 (= 68°B)	.7069 (= 68° B)
Boiling point	55 to 60°	55 to 60°
Fract. Distillation	83%	82.75%
Residue	17%	17.25%

The fractions in the main tallied, 10 fractions taken, residue tallied.

GOLD

Chain, query if gold and what carat.

1.34 grams melted with a 5-cent piece, rolled, quarted in dilute nitric acid. Filtered, washed free from Ag and Cu, dried insoluble and ashed. Mixed with 10 grams of test lead and cupelled. Gold button .035. Checked by weighing the gold from the quartation with $\mathrm{HNO3}$, .036.

Therefore $\frac{.035 \times 100}{1.34}$ 2.612% of gold. As 24 carats equals pure gold.

Therefore, 100:2.61::24 .62 carats, or say ½ carat gold.

Foil, gold solder, .784 dissolved in dilute HNO_3, filtered and washed free.

Residue, .228 Au. = 29.08% Au. 100:29::24 = 4.98 equal to 5 carat gold.

The silver ppted in filtrate by HCl .318 AgCC, 30.48% silver.

The filtrate examined for bases gave a trace of zinc and copper.

Plate, a 1/16 in. metal plate.

One gram disolved in HNO_3. Au = .160 = 16% of gold.

100:16::24 = 3.8 or 4 carats. Filtrate gave Cu and ZN = brass.

Waste, (jewellers' waste), also dental.

There is not much use trying to sample, the better way is to either melt it all down in a large crucible with test lead and cupel, or if a metallic powder, treat wet; in either case. Roll out into a cornet, shave or file up. Wash well with water to remove borax, plaster and zinc soldering salts by decantation. Digest with cold dilute hydrochloric acid, to remove all soluble in that acid. Decant off, and wash free, then digest with HNO_3 to remove Pb and all soluble in HNO_3. Decant off, and digest with cold aqua regia which will dissolve the gold but has little effect on platinum. Treat repeatedly with aqua regia until the solution is fairly free from yellow color. Place this solution to one side for gold, = (A). Then treat with hot aqua regia and dissolve out the platinum and trace of gold = (B). Lastly, pan the residue and pick out large pieces of gold or platinum which have escaped solution.

Evaporate A and B down to a syrup, dilute largely (400 cc's). Add warm sol. of ammonium oxalate and then oxalic acid, place in the sunlight for 24 hours. The gold is ppted as a sponge. Filter and retain filtrate for platinum. Dry the gold and fuse with borax. Place the filtrate containing platinum in a large beaker and hang some zinc strips or rod in the solution. The platinum is ppted as metal on the zinc and can be rubbed off, purified and weighed as platinum sponge.

Waste weighed 108 grams yielded 86.37 gold. No Pt or Ag

RESULTS (DENTIST WASTE).

117 grams of waste = 31.47 grams of gold, of 24 carat.

86.23 grams of waste = 63.30 grame of gold, of 24 carat.

123 grams of waste = 64.1 grams 40 dwts at 80 cents per dwt. $32 value.

The platinum and silver not recovered. Roughly about 40 cents worth of aqua regia will be used for $20 worth of gold recovered.

HYDROSULPHITE

Hydrosulphite, hyposulphite of soda are commercially identical, in fact in some price lists are bracketed. But hydrosulphite is (formula Na2S2O4) (Jour. Soc. Chem. Ind. 1911, page 419), in fact it is a polysulphite, constitution uncertain, and may contain from the manufacture, sulphites, and sulphates as well as the main constituent hyposulphite. It is naturally much drier than sodium hyposulphite, and therefore contains more available SO2 and S, and thus is termed, concentrated hyposulphite or hydrosulphite. According to Muspratt (vide Thorpe, dict. of chem., page 439), it is a meta sulphite. This salt was formerly known as anhydro sulphite, and is used for all the purposes that hyposulphite is used; i.e., as an antichlor, indigo reducer, bleaching, etc.

Hyraldite, is a hrydrosulphite of zinc and gives the hyposulphite reaction with zinc and soda as bases. It is a solid white salt.

Hyraldite, special, is the same, but contains also an organic salt (reducing agent). It is a solid white salt.

Reducite, is a mixture of hyposulphite or hydrosulphite of soda, zinc dust, and glucose, and if filtered rapidly no zinc is found in the filtrate. If let stand, hydrosulphite of zinc is formed, a grayish white salt.

Blanket Z, is a patented mixture. It gives an excess of S with HCl, forming a yellow solution which nearly immediately gives the hypo react. of pt. of S. and SO_2. It is mainly a polysulphite of soda, with addition of soda salts. It is used in dyeing and to a limited extent as a sugar bleech. Meta bisulphites are also used in photography.

LITOPONE

Is a substitute for zinc white (ZnO) made by roasting ZnS with barytes. It consists therefore of zinc sulphide, zinc oxide, and barytes.

ANALYSIS.

2 grams dissolved in HCL, tested for H_2S by odour and lead paper. Filtered, washed clear. Ppt is $BaSO_4$. Ignite this and weighed. Confirmed by fusion with sodium carbonate. Tested filtrate for Pb by H_2S, generally absent. Filtered oxidized and the zinc ppted by NH_4OH and H_2S, and ignited to ZnO, but generally qualitative is sufficient ,therefore zinc by difference. Sometimes Ca is found in the filtrate on account of whiting having been added instead of barytes.

	A	B	C	D
ZnS and ZnO	30.4	65.4	26.0	38.0
$BaSO_4$	69.6	34.6	74.0	...
$CaCO_3$	..	...	...	61.7

LEAD FUME

Is a flue dust from the refining of lead ores and consists essentially of lead sulpahte with some mechanically carried lead sulphide, also a trace of PbO from oxidation, with natural coal ash mechanically carried over.

ANALYSIS.

2 grams disolved in dilute HCl, search for H2S by lead paper. Filter, wash well, residue is the insoluble. Filtrate ppted by H2SO4 plus alcohol for total lead as PbSO4. Filtrate boiled plus ammonium hydrate, gives Fe2OH6 and Al2OH6, filtrate from NH4OH tested for zinc, as some lead ores contain black jack, (zinc sulphide). Zinc determined by H2S, if small ignited to ZnO. If large dissolve in HCl and ppted by sodium carbonate and ignited to ZnO.

	A	B	C	D	E	F
Ins. ash	7.0	29.00	8.67			
BbSO4	40.0	71.0	72.17	94.4		
Pb (free)			3.00		72.12	
Water			16.16			
Oil			present			
ZnO	53.0					
SO4				27.3		

The analysis results are not definite, the PbSO4 ranging from 40 to 90%. Ash is present in some cases, also wood tar and creasote oil, sometimes water. Sometimes it is sublimed lead, blue lead, actually metallic lead.

METAL

For alloying gold, one gram dissolved in diute nitric acid no insol. and evaporated. No Zn nor Au. Evaporated with H2SO4, no lead, eleltrolysed. Weighed the copper – ZNS = ZnO = 21.0 Zn = Cu 78%.

C. T. Metal, used for coffin trimmings	Pb	85%
	Sb	14%
		99.
Star metal	Pb	87.42
	Sb	12.51
		99.93

MANGANESE METAL

A gray crystalline fracture ,hard copper lustre.

One gram dissolved in dilute nitric acid, evaporated no SnO_2, del. filtrate to 25 0cc's. 100 cc's evaporated with sulphuric acid giving no lead. Electrolysed the solution giving—70.88 Cu, residue + NH_4OH and NH_4Cl, giving trace of $Fe_2(OH)_6$ filtered and ppted the Mn by bromine. Filtered and ignited getting .72 Mn, confirmed by fusion and borax bead. The filtrate from the bromine was boiled off and the Zn and P_2O_5 tested for, a little zinc, but no P_2O_5, therefore manganese copper.

Stencil metal,	Pb	85.30		
	Sn	14.24		
		99.54		
Tin foil,	Pb	20%	88%	93%
			12%	6%
	Sn	80%	100.00%	99%

Medal = Ni 30% −Cu 48% − Zn = 23%.

NICKEL PLATE

The ordinary nickel plate is nickel deposited on a clean mettallic surface and afterwards polished or burnished. Cheap goods, such as can openers, etc., are only nickel washed and have only a mere blush of nickel. For nickelled iron, treat article with fused ammonium nitrate, for rods in a test tube, flat articles in a capsule. See that the article is covered with a fused nitrate and stop action when oxide of iron is formed, in the case of nickel plate the mass is apple green in color. Digest with water, separate and identify nickel by usual tests. An approximation can be made by weighing the article before and after treatment. In the case of copper or nickelled brass the above partially fails as the fused Am. Nit. attacks the metal, but the copper can be ppted by H_2S in a faintly acid sol. filtered out and the Ni and Zn separated in filtrate.

Sample of nickel, a silver yellow rod, magnetic. Qualitative, Ni and Cu.

ANALYSIS.

Copper	.7
Nickel	95.6
Iron	trace
Carb., etc.	...
	96.3

Nickel Silicon, ingot, non magnetic.

ANALYSIS.

SiO_2	10.46
Ni	....
Fe	74.98
MN	8.24
Carbon, etc.	6.32
	100.00

Therefore, ferro silicon + ferro manganese.

OILS

Oils, fats, and waxes have been so well threshed out by Lewkowitsch and others, that their results are classic. But all depends upon manipulation. If a standard or official process is altered ,the constants are changed. The analyst must then determine his constant, consequently in table of results, either standard methods have been adopted or the sample has been duplicated with a genuine sample.

ANALYSIS.

Appearance noted, the bloom especially, if petroleum is suspected. Gently heated on a platinum. Petroleum, resin, coconut, etc., give characteristic odours. Ash. In drying oils lok for lead, zinc, manganese, boric acid, as driers.

Specific gravity, confirmative if an unmixed oil, only suggestive if a mixture.

Melting point, boiling point, and refractive index, as above.

Saponification, definite in genuine oils, but suggestive only in mixtures. About 1.5 to 2 grams weighed into an erlenmeyer flask and 25 cc's of approximately N/2 alcoholic potash added (absolute alcohol used). A blank is also started and the two boiled on an electric heater, under the inverted condenser, for half an hour, and then cooled. Much petroleum is noted by a layer of unsaponifyed fluorescent oil floating on the top of the liquid. If the petroleum content is slight this will not be noticed, as petroleum is more or less soluble in alcoholic soap solution. Solid parafine and cerasin separate out on cooling. Add phenolpthalein and titrate by N/2 HCl and calculate to milligrams of potash to one gram of the fat which is the saponification No.

EXAMPLE (PEANUT OIL).

Taken, 1.579 grams of the oil + 25 cc's N/2 potash = 15.3 N/2 HCl, the blank taking 26.0. Therefore 26.0 – 15.3 = 10.7 N/2 or 5.35 N. $\frac{5.35 \times .056}{1.579}$ = 189.8 mms. KOH per gram of oil (Lewk., page 443, 189,192).

On titrating by the N/2 HCl, the following is noted, if a saponifiable oil; no ppt. is formed by the acid, if it contains petroleum or much stearin a turbitity is produced, in that case immerse the flask in hot water and titrate the hot solution, when neutral dilute with hot water to the neck of the flask, the solution becomes alkaline from hydrolysis of the soap, and on standing, the petroleum rises in a layer and can be recognized. If petroleum is found, a rough approximation of the amount can be made by taking 10 to 20 cc's saponifying by strong alcoholic potash, diluting in a separating funnel and running the liberated petroleum into a graduated test tube is accurate from about 3 to 4% by volume or by boiling from 10 to 20 cc's with an equal amount ocf acetic anhydride, cooling, diluting, and measuring the petroleum. This is preferable to extracting with pet. ether, as that method generally results in a difficult emulsion, and in any case most petroleums even kerosine, are sensibly volatile at 100°C.

Some waxes and hard stearins are not easily saponified by alcoholic potash. In this case the saponification has to be effected in a pressure flask. This can be avoided by dissolving the wax in amyl alcohol, which has been distilled with KOH; (this is essential) and proceeding as usual; but in that case parafine wax will not separate as it remains in the amyl alcohol. If parafine wax is suspected it is better to take a larger quantity and boil with strong alcoholic potash for an hour, dilute with hot water and separate the parafine as a layer. Unsaponified matter, stearin, waxes, etc., separte at the same time, but the parafine cake is easily separated from them, as they are soft and washed away by decntation.

EXAMPLE (BEESWAX.)

Tken, 1.606 grame + 20 cc's amyl alcohol + 25 cc's N/2 alc. pot.

Took 18.5 cc's N/2 HCl. Blank took 23.5 cc's = 5.0 cc's N/2 or 2.5 cc's N. HCl.

Without amyl alc. in a pressure
Therefore $\frac{2.5 \times 056}{1.606}$ 87.16 Sap. No. flask 94.1 mean 90.6.

Beeswax Mixture, taken 1.616 grams + 20 cc's amyl alcohol + 25 cc's N/2 alc. KOH. Took 25.7 cc's N/2 HCl. Blank took 26.6 cc's N/2 HCL = 2.9 N/2, or 1.45 N ∴ $\frac{1.45 \times .056}{1.616}$ = 50.25.

Stearine substitute, found parrafine 68%, balance stearine. Parrafine identified by heating with H2SO4, it not being polymerized. By weight = 65%.

Acid No., free acid due naturally, or by rancidity.

Useful in determining beeswax, and also if an oil, such as coconut, is edible or crude.

5 to 10 grams dissolved in a beaker in 50 cc's absolute alcohol by heat. Immersed in a beaker of hot water and titrated hot by N/2 alkali using phen. as an indicator. The first change of color is taken, otherwise the excess of alkali will saponify the neutral fat. Results calculated to Acid No. and to oleic acid.

EXAMPLE (COCONUT OIL.)

14.535 grams + 50 cc's alcohol = 6.6 N/2 KOH = 3.3 N. KOH.

Therefore $\frac{3.3 \times 056}{14.535}$ 12.72 Acid No. $\frac{3.3 \times 282}{14535}$ 6.40 as oleic acid.

RESULTS OF ANALYSIS.

Oil	Acid No.	As oleic acid.	
Fish	1.27	.643	
Fish (old)	21.88	10.990	
Copra	25.00		
Copra (Ceylon)	5 to 10		
Beeswax.....	20 to 22		
"	9.1		30 to 35% Parrafine wax
"	9.1		35% Parrafine wax
"	1.0		75% or more Parrafine wax
"	2.9		25% or more Parrafine wax

Ether No., difference between the Acid No. and the Saponification No.

Beeswax, Sap. 90.6. Acid No. 20.0. Ether No. 70.6.

Iodine No. Whatever process for iodine or bromine absorption is used, it should be strictly adhered to. Hubl process used in these determinations.

Iodine solution, 25 grams iodine (resublimbed), dissolved in 250 cc's of 95% alcohol. 30 grams HGC12 dissolved in 250 cc's of the same strength alcohol. Solutions mixed and made up to 1 litre. Let stand 24 hours and filter.

Hypo solution, 24.6 grams per litre.

Potassium iodide, 150 grame per litre.

The hypo solution is standardized against a known weight of resublimed I2, about .5 to .7 grams Iodine taken.

ANALYSIS.

1.5 to .7 grams of oil or fat is weighed into a light glass stoppered flask of 100 to 150 cc's capacity, gently warmed and 10 cc's of CHC13 added, then an excess of iodine solution, generally 30 cc's is sufficient. A blank is started at the same time and allowed to rest in the dark for three hours. It is then transferred to a large erlenmeyer flask being rinsed with 20 cc's KI solution into a large flask of a cap. of 150 to 200 cc's, wel shaken and titrated by the hypo until the solution is nearly colorless, then starch solution added and the titration completed. It is essential to agitate vigorously near the end of the titration to ensure that the iodine is all removed from the chloroform.

EXAMPLE (COTTONSEED OIL).

.516 grams + 50 cc's of Hubl sol. Used 45 cc's of hypo to neutralize the excess of iodine. Blank took 77 cc's, therefore 32 cc's absorbed. 1 cc of the hypo 0.176 I2 $\frac{32 \times 0.176}{.516}$ = 109.2 Iodine No.

SNAP COMMERCIAL ANALYSIS.

(COCONUT OIL.)

.574 grams + 25 cc's of Hubl. Used 25.5 cc's hypo. Blank took 28.8 3.3 cc's absorbed. 1 cc hypo .0147 I2.
= 8.45 Iodine No.

CHARACTERISTIC VALUES OF OILS, FATS AND WAXES

VEGETABLE.				FATTY ACIDS.	
Name	Sp. Gr.	Iodine Value	Sap. Value	Iodine Value	Sap. Value
Cotton Seed	.9220	108-110	193-195	111-115 147-151	202-208
Sesame Seed	.9230	103-108	189-193	110.45 129-136	200.4
Maize Corn.	.9213	113-125	188-193	119.5 140-144	198.4
Castor	.9600	83-86	183-186	87-93 106.9	192.1
Linseed	.9315	171-201	192-195	179-182 190-201	197
Olive.	.916	79-88	185-196	86-90 95.5-103.5	193
Olive Kernel	.9184	87.4	183		
Cotton Seed Stearine.	.9188	90 108	195	94	
Shea Butter	.9175	56.6	179-192	56-572	
Palm Oil.	.921	51.5	196-102	53.3 94.6	205.6
Vegetable Tallow	.9180	28-37	200.3	30-39	182-206
Cacao Butter	.9500	32-41	193.55	33-39	190
Kokum Butter.	.8952	32.6	187-191		198.9
Cocoanut Oil.	.9115	8-9.5	246-260	8.4-9.3 54	258-266
Japan Wax	.9700	4.9-8.5	217-237.5		213.7

Sample	Sap No. mms. per gr.	Iod. No.	Acid No.		Ether No.	M. P.	Sp. Gr.
			No.	Ol. acid			
Cocoanut.	246.9	9.86					
	256.0	11.60					
	253.7	12.70					
	257.1	12.90					
	255.7		.3				
	256.5	11.2					
	258.0						
	259.0					19-20	.8707
	257.0					20	
						22-23	.9023
Crude cochin .	260.0					23	.9018
	255.8					22-23	
Coprah.........			21.8	10.90			
Ceylon			35.0				
			5.10				
			1.3	.64			
			1.50	.82			
	258	6.3	6.29	3.16			
			12.72	6.45			
			.85	.18			
			1.30	.82			

OILS (Miscellaneous.)

Putty Oil, a mixture of linseed oil and petroleum, 70% mineral oil.

Stuffing Oil, soft soap + a little free oil (fish) used in leather dress.

Harness Oil, a colored petroleum oil.

Insulating Oil, a petroleum oil with dissolved resin.

Tallow Oil, the fluid oil expressed from tallow. Sap. No. 196.7, Iod. No. 80.6.

Heavy Oil, coal tar oil, with a Sp. Gr. of .9699. Dead oil.

Oil of Tar, wood tar creasote.

Creasote Oil, some sink in H2O, if C.T. heavy oil, if lighter C.T. oil.

Banana Oil, impure amyl acetate.

Asphaltum Oil, a petroleum residum oil, used for thinning asphaltum.

Japan Oil, a lacquer + wood naptha + linseed oil, gum resin. Stoved = a varnish.

Pineapple Oil, ethyl butyrate, no alcohol, but free F. A.

Skid Oil, generally crude petroleum, sometimes residuum oil, used in greasing timber chutes.

Red Oil, should be distilled oleic acid ,often only petroleum oils.

Sample of red oil, Sap. No. 188.9, Iod. No. No unsaponiyable.

Sample of red oil, Sap. No. 0, Sp. Gr. .9045. This sample was unsaponifyable ,red fluorescent = mineral oil.

Rosin Oil, sinks in water, Sp. Gr. 1.0112, soponification, slight. Gave a ppt of fatty acids, also storch reaction with acetic anhydride.

Wood Oil, odour camphor, sap. 191.8. Stoved, a hard opaque varnish, S.G. .940. Refractive index, 1.518.

Pine Oil, sp. gr. .9511, ref. ind. 1.4929, polymerization nearly complete, is a low grade, turpentine oil.

Elaine Oil, oleic acid, Sap. 193.8, Iod. No. 80.444.

White Oil, bleached vaseline oil, Sp. Gr. .863 to .865, unsap. Odour, petroleum.

Transformer Oil, a petroleum residuum oil, Sp. Gr. .858, used for filling E. transformers.

Emulsifying Oils, petroleum oils, with about 2% dissolved soap.

Sed Oil, liquid degras.

Linseed Oil, see table; but there is a number of linseed oil substitutes under various trade names, consisting generally of linseed oil with pine oil or kerosene admixture.

A. Sap. No. .79.1, unsap. kerosene and pine oil, about 10% linseed.

B. Kerosene and pine oil, only a trace of linseed oil.

C. Kerosene 80%, linseed oil 20%.

Linseed Oil (boiled), see text books. Look for drier in the ash.

Lithographic Varnish is a boiled oil, and occurs in three grades, "strong," "medium," "thick," is linseed oil simply boiled down, or blown, and contains no drier.

OIL OF TURPENTINE (Spirits of Turpentine.)

Is the oil or spirit contained from the first fraction of ordinary turpentine distillation, and is often adulterated with the second fraction, rosin spirit and as the supply of turpentine is falling short, it is now grossly adulterated with gasoline, in fact many so-called spirits of turpentine are turpentine substitutes. The detection and rough estimation of gasoline is simple, rosin spirit is difficult. For official process, see Stillman Engineering Chemistry, page 535.

A. It must be water or prime white in color.

B. Sp. Gr. to be between .862 and .872 at 60°F.

C. Boiling point, 310 to 320°F. and at least 95% must distill under 338°F.

D. Evaporated at 212, residue not to exceed 2%.

E. Polymerization, 6 cc's slowly mixed with 24 cc's H_2SO_4 (conc.) in a cooled graduated cylinder and let stand 30'. Not more than 6% must separate as a clear layer.

I find B, C, E, with the refractive index, sufficient. The bromine absorption takes too long for a rough estimation. Sometimes the sample was fractionally distilled and the different fractions observed, but it is rarely necessary.

SPIRITS OF TURPENTINE.

Sp. Gr.	B. P.	Refr. Index.	Polymerization	Remarks
.8685	Grad. rise	1.4768	Complete	Rosin spirits.
....	150°C.	1.4778	Almost complete	Genuine turpentine.
.8616	159°C.	1.480	" "	" (Russian).
....	114°C.	1.464	Partial	35% petroleum, a substitute.
	155°C.	1.4667	"	40% " "
	154°C.	1.4637	"	44% " "
	125 to 130°C.	1.456	"	50% " "
.8181	124°C.	1.483 ?	"	50% " "
		1.489	"	60% " "
.7817	130°C.	1.4377	"	67% " "
	153°C.	1.4457	"	69% " "
		1.449	"	77% " "
.7861	145°C.	1.438	"	80% " "
.7933	146°C.	1.4395	"	85% " "
.7754		1.4335	"	100% " (straight petrlm.)

SUGAR

For trade and duty purposes the polariscopic examination is sufficient, and if conducted with ordinary care. observers do not vary, but there are certain suorces of error which cause duplicate samples to vary, even though the tests are made by competent observers.

The principal sources of error are:

1st. Incomplete or bad sampling. No analyst can be held responsible for differences from that cause. He will mix his own sample, so will the other analyst, but if the samples are not originally identical the results will not agree ,also a difference in date (vide 2).

2nd. Dying of sample in transit is a fertile source of error, therefore the sample should be turned out and well mixed.

3rd. Experimental error is a constant, due to the analyst' perceptions of vision; therefore he should set his own instrument with quartz plates and a solution of pure sugar. The so-called sugar flasks are sometimes inaccurate (100 to 110 cc's) and should be standardized. The 2 dem. tube(s are as a rule accurate, but are tested by a pure sugar solution and also for length. Excess of basic lead should be avoided. The lead error is so slight in ordinary samples that it can be neglected, as for trade purposes the price or value is based on ⅛% plus or minus. Care should be taken that the filtration should be rapid, and the funnel covered to prevent evaporation and absorption of CO2, the last being the general cause of cloudy filtrates, therefore the filtrate is read as soon as possible and not left to stand.

Animal charcoal should not be used if possible, if used add the minimum quantity. To avoid clerical error the duplicate should be made by another observer. (United States official instructions attached). As far as sampling molasses is concerned, as there is usually two or three inches of sludge in the barrel or other container, and that must be mixed with the barrel volume. It is obviously a practical impossibility to get two samples from the same barrel to read the same sugar content. The same happens in clear molasses as it separates into layers of unequal density, and being a syrup takes time to attain a homogeneous mixture, consequently the sample is taken as collected.

For **reducing sugar** it is more convenient in a single sample to make a gravimetric determination than to standardize a volumetric copper solution. Therefore take 1 to 5 grams of sugar, acording to its grade, dissolve in 50 cc's of warm water and in another beaker place sufficient Fehling in excess (Violettcs solution)to have about 10 cc's in excess, generally 20 cc's is sufficient, dilute to approximately 50 cc's, and raise to boiling. While boiling add the hot sugar solution slowly, so to not stop the boiling. Let boil three minutes, remove, let stand in water oven 5 minutes, total time 10 minutes. Filter rapidly b yaid of pump through Gooch's filter or asbestos filter, wash four times with hot water ,once with alcohol and dry in oven at 100° to 110°. You can weigh the CuCO in one hour. Cu2O × .456 for accurate work, × 5 for rough. Six determinations can be made in one hour. I use the factor .456 for invert sugar, as I found it more exact, but the analyst for a series of determinations should determine his own factor under his own conditions.

Rendement, that is the amount that a raw sugar on refining will yield in sucrose, is dependent on the interfering action of invert sugar or reducing sugar and ash. It is an arbitrary conclusion and the factor varies with the country, therefore, the factor used should be stated or the official factor of the International Sugar Chemists adopted.

Ash, usually determined as sulphated ash, that is, the sugar char is treated with H2SO4 and ignited to white ash, or it can be determined as true ash by ignition of the sugar char in muffle furnace.

Inversion is about the only way that sucrose can be determined in a mixture of sugars. It depends upon the fact that a solution of cane sugar that reads to the right or plus, will on inversion read to, the left or minus, equivalent to the amount of sucrose present, supposing that the other sugars are not inverted by the acid used.

The original Clerget factor depends upon the fact that a solution of sucrose reading plus 100 will on inversion read minus 44, therefore the factor is as 100 to 144 and tables on inversion are given in works on sugar.

The No. 144 however depends upon the temperature at which the invert is read. The original number has been more accurately determined and the factor slightly changed. In some cases the inversion is not caused by acid, but by a yeast ferment Invertase.

THE CLERGET INVERSION PROCESS FOR SUGARS AND MOLASSES.

Process as for solid sugars, the normal weight taken, clarifyed by basic lead acetate and read as usual in the polariscope.

For syrups and molasses the ½ normal weight is taken, clarifyed and read as usual, giving the direct reading. 50 cc's of the clarified sugar solution has then 2 cc's of strong HCl added, mixed, immersed in a water bath at 75 to 80°C. and kept there for twenty minutes, cooled and let stand until it attains room temperature, make up to 55 cc's, filter and read in the polariscope, the temperature being noted. Either use an inversion tube fitted with a thermometer, or read rapidly and take temperature of tube, increasing the reading 1/10 to allow for dilution. This gives the invert reading. The factor (Wohl's) 142.7 was found more accurate than 144, therefore Clerget's Inversion is represented by the following formula:

$$\left.\frac{\text{Direct reading plus invert reading,}}{\text{142 minus } \tfrac{1}{2} \text{ temp. (invert).}}\right\}\text{equals \% of sucrose.}$$

In sugar mixtures where the plus sugar predominates, the difference is taken in corn syrup the direct polariscope must be read rapidly as birotation may cause a loss by error if let stand.

See table below, by the author, in the "Analyst," of October, 1891.

For identifying a sugar the specific rotation is observed in a polariscope reading circular degrees, the sodium light being generally used.

Specific rotation; divide the angle of rotation by the length of the tube, and divide by the number of grams in 1 cc of solution.

EXAMPLE—CANE SUGAR.

The normal weight in a 2 dcm. tube equal to plus 34° .07. Therefore $\frac{34.07}{2}$ =17.03 divided by 26048 = 65.4 (Allen = 66.5), confirmed by copper reduction.

	Number of determinations	Direct polariscope in per cent.	Invert polariscope in per cent.	By Clerget.	DIRECT.				INVERTED.				Cane sugar by difference of Cu_2O.	Other sugars by difference of Cu_2O.	Water.
					Amount taken.	Cu_2O obtained.	Difference, max. and min.	Factor.	Amount taken.	Cu_2O obtained.	Difference, max. and min.	Factor.			
Cane Sugar	10	+100	..	..	2.5	.001	.0005	..	.25	.541	.002	48.61	90.92	..	.0
Grape Sugar (corn)	4	+79.6	+79.7	..	.25	.530	.002	.4717	.25	.5385	.001	..	..	100.00	.0
Equal Weights Grape and Cane Sugars	4	+88.92	+25.84	49.40	.50	.532	.003	.4717	.25	.547	.004	..	50.35	50.18	.0
Milk Sugar	4	+76.8	+78.6	..	.25	.361	.001	.6944	.25	.363	.004	..	..	100.26	.0
Starch Syrup	4	+153.8	+101.0	..	.5	.463	.004	1.08	.5	.477	.004	..	..	..	..
50 pts. Starch Syrup 50 pts. Cane Syrup 50 pts. Water 33.3 per cent. of each	4	+43.1	+21.0	34.3	.5	.166	.002	1.08	.5	.536	.002	..	34.6	35.86	..

EXAMPLES, DRY MILK, A AND B.

A had milk sugar removed; B equalled dry milk; C ditto.

2 grams suspended in 100 cc's cold water plus 5 cc's basic lead acetate, then MgSO4 in slight excess, made up to 200 cc's, let stand, filtered. Took 50 cc's (.5 grams) boiled with Na2CO3 to precipitate the magnesia, filtered and washed. To boiling filtrate added hot Fehling in slight excess, as a white flocculent ppt. settled and separated with the Cu2O. Filtered on paper, washed, transferred ppt. to beaker and dissolved the dilute HNO6. Evaporated with 5 cc's H2SO4 and determined by electrolyses

A. .016 Cu × 200 gave 3.2% × .7707 (factor for milk sugar) 2.46% M.S.

B. .225 Cu × 200 gave 45.0 % × .7707 (factor for milk sugar) equals 34.65% M.S.

C. .196 Cu × 200 gave 39.0% × .7707 (factor for milk sugar) equals 30.21% M.S.

If cane sugar is suspected, the solution after the boiling with Na2CO3 is neutralized by HC1, then inverted by 2 cc's HC1, made just alkaline by HC1 ,then inverted by 2 cc's the total copper being determined by electrolyses. The difference between the direct and inverted copper is calculated to cane sugar.

MOLASSES AND GOLDEN SYRUP, ETC.

	Pol. direct	Pol. invert	Temp. ccd.	Clerget	Diff.	Red. S
Barbadoes	53.3	14.0	20	49.9	3.4	15.75
Antigua	54.3	13.8	20	51.3	3.0	11.96
Porto Rico	52.6	13.6	19	49.8	2.8	15.06
St. Kitt's	51.6	14.8	20	49.9	1.7	16.82
St. Croix	51.0	14.2	20	49.0	2.0	13.42
Trinidad	52.0	15.8	20	51.0	1.0	22.75
New Orleans (prime)	21.2	15.4	20	28.1	6.9	32.08
do (common)	24.1	16.4	20	31.6	7.5	37.22
do (fair)	40.0	17.2	16	42.4	2.4	18.28
Georgia (sirop)	53.8	15.4	20	52.0	1.8	13.80
Minnesota (sorghum)	40.0	14.2	20	40.8	.8	26.91
Illinois do	35.6	11.4	20	35.4	.2	36.65
Molasses (adulter.)	52.8	20.6	20	22.7	33.1	30.33
Golden Syrup	varies	varies	..	varies	some minus	some plus

Some are practically invert sugar, other mixture partially inverted cane sugar.

UNITED STATES REGULATIONS CONCERNING SUGAR TESTS.

Standardization of Instruments.

The Polariscope to be set at zero and by the trial quartz plates, also by a normal weight of pure sugar = 100%, once a month. The N sugar weight must weigh 26.048 grams, the balance in right adjustment. Every 100 cc flask must contain 100 grms. of water at 60. Fahr. Every tube used must read 100. with N weight of pure sugar.

Preparation of Sugar Solution.

If the sample is not entirely uniform, it must be thoroughly mixed before weighing, after all the lumps are broken up, best with a mortar and pestle. Then 26.048 grams are weighed on the balance in the tared German silver dish furnished for this purpose. Care must be taken that the operations for mixing and weighing are not unduly prolonged, otherwise the sample may easily suffer considerable loss of moisture, especially in a warm room. The weighed portion of sugar is washed by means of a jet from a wash bottle onto a 100-cubic-centimeter flask, the dish being well rinsed three or four times and the rinsings added to the contents of the flask. The water used must be either distilled water or clear water which has been found to have no optical activity. After the dish has been thoroughly rinsed, enough water is added to bring the contents of the flask to about 80 cubic centimeters, and it is gently rotated until all the sugar has been dissolved. The flask should be held by the neck with the thumb and finger and the bulb not handled during this operation. Care must be taken that no particle of the sugar or solution is lost. To determine if all the sugar is dissolved, the flask is held above the level of the eye, in which position any undissolved crystals can be easily seen at the bottom. The character of the solution is now observed. If it is colorless or of a very light straw color and not opalescent, so that it will give a clear, transparent liquid on filtration through paper, the volume is made up directly with water to the 100-cubic-centimeter mark on the flask. Most sugar solutions, howeber, will require the addition of a clarifying or decolorizing agent, in order to render them sufficiently clear and colorless to polarize. In such case, before making up to the mark, a solution of sub-acetate of lead is added, which is prepared as follows: Boil an aqeuous solution of lead acetate with an excess of lead oxide (PbO) for half an hour, and make filtered solution of a concentration of about 1.25 specific gravity. Solid sub-acetate of lead may be substituted for the normal salt and oxide in the preparation of the solution.

The quantity of this agent required will vary according to the quality of the sugar. From 20 to 60 drops (1 to 5 cubic centimeters) will answer for most sugars; for molasses, more may be required.

After adding the solution of sub-acetate of lead, the flask must be gently shaken, so as to mix it with the sugar solution. If the proper amount has been added, the precipitate will usually subside rapidly; but if not, the operator may judge of the completeness of the precipitation by holding the flask above the level of the eye and allowing an additional drop of sub-acetate of lead to flow down the side of the flask into the solution. If this drop leaves a clear track along the glass through the solution, it indicates that the precipitation is complete. If, on the other hand, all trace of the drop is lost on entering the solution, it indicates that an additional small quantity of the sub-acetate of lead is required. The operator must learn by experience the point where the addition should ceanse; a decided excess of sub-acetate of lead solution should never be used.

The solution is now made up to the mark by the addition of distilled water in the following manner: The flask, grasped by the neck between the thumb and finger, is held before the operator in an upright position so that the mark is at the level of the eye, and water is added, drop by drop, from a siphon bottle or wash bottle, until the lowest point of the curve or meniscus formed by the surface of the liquid just touches the mark. If bubbles hinder the operation, they may be broken up by adding a single drop of ether, or a spray from an ether atomizer, before making up to the mark. The mouth of the flask is tightly closed with the thumb, and the contents of the flask are thoroughly mixed by turning and shaking. The entire solution is poured upon the filter, using for this purpose a funnel large enough to contain all the 100 cubic centimeters at once, and a watch glass is placed over the funnel during filtration to prevent a concentration of the solution by evaporation.

The funnel and the vessel used to receive the filtrate must be perfectly dry. The first portion of the filtrate, about 20 to 30 cubic centimeters, should be rejected entirely, as its concentration may be affected by a previous hygroscopic moisture content on the filter paper. It may be necessary to return subsequent portions to the filter until the liquid passes through perfectly clear.

If a satisfactory clarification has not been obtained, the entire operation must be repeated, since only with solutions that are entirely clear and bright can accurate polarimetric observations be made.

Sources of Error.

The following principal sources of error must be especially guarded against:

1. Drying of sample during weighing.
2. Excess of sub-actetate of lead solution in clarification.
3. Incomplete mixing of solution after making up to mark.
4. Imperfect clarification or filtration.

5. Concentration of solution by evaporation during filtration.

6. Performance of polarization with a cloudy, dim, or not completely round and sharply defined field.

All tests in duplicate, one test by each observer—mean taken.

SACCHARIN

Saccharin is generally the soda or ammonia salt. It identification is simple. It is intensely sweet. If fused with KOH at not over 210 to 220°C. extracted by water, sulphuric acid added and the salicylic acid formed extracted by ether, it gives the characteristic reactions with ferric chlorid and formation of methyl salicylate.

EXAMPLES.

Sweetner, was solid sodium saccharate.

Sweetner, was solid ammonium saccharate.

Porcheine, was a syrup composed of sodium saccharate plus glucose.

Sweetol, a syrup of ammonium saccharate.
Sucramine, solid, ammonium saccharate.
For separation in mixtures, see journals.

SUCRATE OF LIME

Is used to sweeten cream or butter. The sample in question was a gummy or syrupy solution.

ANALYSIS.

Normal weight (26.048 grams) diluted to 100 cc's and a current of CO_2 passed through. Boiled off the excess of CO_2, filtered into a 200 cc flask, added a few cc's of ammonium

oxalate, let stand and made up to 200 cc's. Filtered and read in the polariscope. It gave 40% of cane sugar. Sucrose 40.0
5 grams ashed and the ash carbonated. Gave 10.38 as

$CaCO_3$ 10.38

Original solution was alkaline, but CaHO not determined.

Water (diff.) 49.62

100.00

Cream thickener, a mixture of gum tragacarith plus sucrate of lime. Sucrose 28.43; Ash ($CaCO_3$) 6.05.

TETRACHLORIDE (CARBON)

Tetrapole, a compound of CC14 and soap. A brown liquid, ignition, green flame, intumescense with soap odour, fusible Na carbonate ash.

A portion evaporated to dryness, dissolved in water, frothed and alkaline. With HC1 it gave fatty acids, therefore a soap. Another portion weighed (13.28 grams) and evaporated with sand, drenched with alcohol, evaporated, drenched with ether, evaporated = to 3.904 grains of soap, which equals 29.0%. 50 cc's diluted and distilled gave 2.5 cc's CC14, which equals 5%.

Soap	30%
Water	65%
CC14	5%
	100.00

Carbon liquid soap, a similar product.

Carbon cleaning fluid, commercial carbon tetrachloride.

Boiling point 76°C.

Specific gravity 1.519.

Qualitative tests, green flame on ignition, odour of sulphur chloride and sulphur flame also CS_2.

Shook up with KOH, separated, accidified with KNO3 plus AgNO3, obtaining silver chloride, therefore Cl.

Heated with sodium metal and obtained reaction for sodium chloride. The vapor had the odour and the flame of CS2.

URINE

The ordinary analysis as done for a physician is only good as an aid to diagnosis. In most cases the analyst is not supplied with data regarding the amount of urine passed, consequently he only gives the % of, say glucose, albumen or nitrogen present. This is useless in tracing the course of a disease. In such cases it should be calculated on the amount of urine passed in 24 hours, giving the physician the loss and conversion of tissue from day to day in fever, or in a week or month, in Bright's disease or diabetes. Also it is not necessary in such a series of analyses that the methods used hould be scientifically correct. It is sufficient for the physician if all the determinations are done under similar conditions and not changed materally. I attach a table of diabetic urine. The method used was the same from start to finish, the only change being in the determination of total solids, which became inaccurate as the sugar contents rose to the maximum. Took the average of the total solids as I believe the errors balance. Did not find the polariscopic test of much value quantitatively, but it is a good indication of the amount of copper solution to add for the Cu2O pptn. Acetone was not determined quantitatively owing to the inaccuracy of the methods.

Process, urine passed, 58 ounces in 24 hours(therefore 58 × 30 = 1740 cc's). Specific gravity by picnometer 1. 04316.

Total solids (calculated from Sp. Gr.) $\frac{4316 \times 2.33 \text{ (factor)} \times 1740}{1000}$ = 174.9 grams = 2699 grains.

Total solids found, 25 cc's evaporated on a water bath with sand and stirred, drenched with alcohol and dried for 4 hours equalled 2.527 × 4 = 10.108%, 100; 1740 ; ; 10.108 = 175.8 grams = 2714 grains.

Polariscope; normal weight calculated from the sp. gr. equals $\frac{26.048}{1.0431}$ equals 24.97 cc's, say 25 cc's + basic lead acetate diluted 100 cc's, read + 4.2.

SNAP COMMERCIAL ANALYSIS.

Sugar (gravimetric), from 120 to 180 cc's Fehling solution according to polarisc. is raised to boiling. 10 c's urine added drop by drop from accurate pipette, boiled for three minutes, let stand seven minutes, filtered rapidly on asbestos filter or Gooch's crucible, washed four times with hot water, once by alcohol, dried and weighed.

10 cc's urine + 160 cc's Fehling = 1.284 Cu_2O × .05 × 10 = 6.42% of glucose. Then 100 : 17.40 : : 6.42 = 111.7 grams = 1724 grains.

Acetone, 100 cc's urine, distilled over 10 cc's ,added iodine solution in excess, then KOH until colorless, a white ppt, obtained, iodoform odour. If in doubt extract by ether, evaporate spontaneously and obtain crystals of iodoform identifying them by their odour.

ANALYSIS (58 Ounces Passed.)

Specific gravity, 1.04316.
Total solids (calculated), 2699 grains.
Total solids (found), 2714 grains, average 2706 grams.
Sugar found, 1724 grains.
Acetone present.
Results calculated in grains on urine passed in 24 hours.

ANALYSIS OF URINE (in grains per 24 hours.)

Date	Urine passed	Sp. Gr.	Solids Calcu-ted	Solids found	Aver age	Polar-is-cope	Sugar Calc.	Sugar found	Aver age	Ace-tone	Solids not Sugar
1910											
July 7	51 oz.	1.0255	1528	1466	1497	+2.0	401	472	436	—	1061
" 14	64 "	1.0210	1499	1427	1438	+2.4	292	474	449	—	989
" 23	50 "	1.0285	1541	1584	1512	+2.4	478	420	449	—	1073
Aug. 2	65 "	1.0145	1015	977	996	.5	146	136	140	—	856
Sept. 1	58 "	1.0281	1775	1713	1729	+2.7	1054	771	912	—	817
" 12	72 "	1.0314	2437	2515	2476	+3.1	1627	—	1627	—	849
" 27	68 "	1.0367	2685	2793	2739	+4.0	2040	1257	1648	—	1091
Nov. 7	64 "	1.0307	2114	2099	2106	+2.5	741	1419	1080	—	1026
Dec. 6	70 "	1.0340	2561	2700	2630	+2.5	775	1820	1257	—	1333
" 20	45 "	1.0354	1712	1666	1689	—3.6	750	1208	976	—	713
1911											
Jan. 3	59 "	1.0364	1974	2375	2174	+3.7	1009	1589	1300	—	874
Feb. 8	67 "	1.0345	2526	2772	2649	+4.0	1241	1838	1509	—	1140
" 23	106 "	1.1610	13351	..	13351	—5.8?	—	5879?	5879?	—	12747?
Mar. 1	80 "	1.0383	3302	3364	3333	+4.5	—	2447	2447	—	886
" 10	96 "	1.0318	3296	3241	3269	+3.6	—	2399	2399	Acet.	870
" 14	70 "	1.0340	2567	2675	2621	+3.6	—	1768	1768	"	853
" 24	78 "	1.0297	2245	2396	2320	+2.4	—	1531	1531	"	789
" 31	73 "	1.0322	2612	2521	2566	+2.8	—	1594	1594	"	972
Apr. 13	67 "	1.0355	2561	2469	2515	+3.6	—	1605	1605	"	910
" 28	63 "	1.0336	2384	2222	2303	+2.7	—	1166	1166	"	1137
June 1	71 "	1.0377	2883	2975	2929	+4.0	—	1791	1791	"	1138
" 21	62 "	1.0399	2700	2778	2739	+4.1	—	1805	1805	"	934
July 6	58 "	1.0431	2699	2714	2706	+4.2	—	1724	1724	"	982
" 26	68 "	1.0366	2421	2492	2456	+4.2	—	1740	1740	"	716
Aug. 10	88 "	1.0369	3503	3596	3549	+4.3	—	2464	2464	"	1085
Sept. 4	died	..	..	..	—	—	—	—	—	—	—

WELDING COMPOUNDS

Of five samples examined, all were iron filings plus borax, one with sulphur, evidently a boiler cement.

WASHING COMPOUNDS

Generally soap powders containing sodium carbonate, but some are simply paraffine wax colored blue, with and without borax. Sometimes in tablet form, consisting of layers of borax and paraffine. 80% paraffine wax and 20% borax, also 80% paraffine wax and 20% sodium carbonate.

WATERPROOF CEMENT

Generaly calcium stearate (lime soap, sometimes magnesium stearate.

WATERPROOF (FISH LINES AND CORDAGE)

Soap, plus fish oil.

WATERPROOF (AWNINGS)

Viscose solution or cellulose acetate, cupra-ammonium, etc.

PAINT AND VARNISH REMOVERS

The old method of removing paint or varnish from wood with caustic alkali has been replaced by a solvent such as benzol or acetone or light wood naptha, sometimes amyl acetate, with sufficient paraffine wax to prevent evaporation. The usual mixture is benzol + methyl acetone or wood spirit containing acetone. Gasoline is not used as it is not miscible with the other solvents.

EXAMINATION OF VARNISH REMOVERS.

100 cc's is shaken with three successive portions of 50 cc's water the contraction represents roughly, the amount of acetone or wood alcohol used the supernatant layer the banzol and paraffine. The latter is divided into two portions, one of which is evaporated for the identification of the paraffine, the other being distilled to identify the solvent.

The united aqueous extracts are distilled to the volume of the contraction observed (which will be, roughly the amount of alcohol or acetone used). If a blue flame is obtained by the flame test, probably only alcohol is present.

The chromic acid test and the formaldehyde test are also then applied.

See acetone and methyl alcohol for the separation of acetone.

Also refer Chemical Industry of March 30th, 1907 (author), and method of analysis.

ANALYSIS.

Contraction with H_2O	Sp. Gr. aq. layer	Alc. wt.	Alc. ?	layer Ins.	Sp. Gr.	B.P	Bens.	Par.	Aet.
25 per cent.	.9682	22.5	methyl	75 pc.	·8795	80	yes	yes	
25 "	.9517	33.6	"	75 "	..	..	"	"	
45 "	.9137	37.8	"	55 "	..	..	"	"	plus
17 "	.9805	12.8	"	83 "	..	..	"	"	"
50 "	.9496	34.7	"	50 "	..	..	"	"	"
25 "	.9718	11.7	"	75 "	·8816	100	" + amy.	"	minus
23 "	.9759	16.54	"	67 "	..	..	..	"	plus
50 "	.9715	20.1	"	50 "	..	..	..	"	minus
30 "	.9740	18.1	"	70 "	..	..	..	"	5 p.c.
50 "	.9587	29.4	"	50 "	..	..	.	"	plus
20 "	..	..	"	80 "	..	..	..	"	"
				100 "			yes	"	"

INDEX

Acetone 5
Alcohol Methyl 10
" Ethyl 11
Acetic Acid 16
Alums 18
Alkali 18
Antimonine 22
Antim. Lead 23
Brandy 12
Bates 24
Brass 25
Borax 25
Coal 26
Cream Thick. 29
Copper Oxide 29
Degras 29
Dutch Metal 30
Dust Absorb. 31
Ether Acetic 31
Essences 32
Enamel White 33
" Essential 34
Embalming Fl. 34
Fillers 35
Fire Xting. 36
Fire Proof 36
German Silver 36
Gasolene 37
Gold 38
Hydrosulphite 40
Litopone 41
Lead Fume 41
Metal 42
Nickel Plate 43
Nickel 43
Oils 44
Preservatives 26
Proof Spt. 14
Oil Turpentine 52
Sugars 53
Saccharin 62
Sucrate 62
Tetrachloride 63
Urine 64
Varnish Remover 9-67
Vinegar 16
Waterproofs 66
Welding Comp. 66
Washing Comp. 66
Wine 13

3
8
3
3
3
3
4
5
4
2
3
2
2
3
4
-67
6
6
6
6
3